Agro Informatics in the Netherlands

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Abstract

In this article the status of Agro Informatics in The Netherlands is described. First of all the Informatics Stimulating Plan is discussed. Then the major organizations that are involved in Agro Informatics and their activities are briefly presented. These include the university of Wageningen, the research institutes, the research stations, the colleges and schools, the extension service and the private software and hardware companies. Finally an evaluation of the developments sofar and the prospects for the near future are given.

Introduction

Dutch agriculture is characterized in particular by intensity. More and more production is taking place on an ever-shrinking surface area by fewer and fewer people. The main considerations for the Dutch farmer or grower to ensure income are product quality, market demand, protection of the environment, low energy cost and of course profitability. One of the means to support the farmer is the use of technology and more specifically the use of computers and informatics. That is why we can see a growth of the importance of Agro Informatics, a growth that is encouraged in The Netherlands by governmental measures like the Informatics Stimulating Plan (INSP).

Computers that are dedicated to process control e.g. milk-yield monitoring, climate control in storage buildings, stables and greenhouses, feed distribution and water/nutrient regulation are widely accepted in The Netherlands. When the farmer uses process control computers he can immediately see the advantages and the introduction does not requires much of his time (NRLO, 1991). The number of farmers that use process automation in 1990 is substantial:

dairy	8000
pigs	5000
arable farming	2000
horticulture	12000

The number of micro (personal) computers with a management system on farms is steadily growing in all sectors (table 1). Many farmers and growers are beginning to see the possibilities of advanced software and hardware systems. But their number is still too small when it is compared to the total number of farmers in The Netherlands (in 1990).

The farmers that buy and use farm management systems at the moment are the early adaptors. They tend to be better educated, work at large farms (NRLO, 1991) and they have very specific wishes concerning the specifications and the possibilities of the software. They sometimes develop their own software, mostly spread-sheet models. The great majority of the farmers is still exploring the possibilities of automation and computers. Software companies can only invest money if the market is repaying and therefore the number of farmers with a micro computer will still have to grow to make the commercial development and application of agricultural software worthwhile.

The Informatics Stimulating Plan (INSP)

Since 1984 the Informatics Stimulating Plan (INSP) of the Dutch Ministry of Agriculture, Nature Management and Fisheries formed a major push for the development of agricultural telematics and farm software (Geuze, 1990 and van Schie, 1990). Through this plan the development and introduction of informatics in agriculture was stimulated.

Branch organizations

As a part of the INSP five branch organizations were set up by the farmers' organizations to stimulate, co-ordinate and direct the development of (management) information systems for farmers: dairy (TAURUS), pigs (SIVA), poultry (SIPLU), horticulture (SITU) and arable farming (SIVAK). At the beginning of 1990 the branch organizations employed in total 34 people. To co-ordinate the branch organizations the central agency COAL was formed.

The goals of the branch organizations are:

- Stimulate the use of informatics on the farms
- Co-ordinate the activities on the field of automation.
- Uniform the use of data-definition.

The branch organizations are financially supported by the Ministry of Agriculture (50%) and collectively by the farmers (50%).
They have started several activities, which can be divided in some main categories:

- Registration and processing of data by hand, with a standard set of forms. This can be seen as a first step towards the use of computers on the farm.
- The use of central computers to process the data of the farms. Videotex systems are part of the evolutionary process towards the use of micro computers on the farm. They can be used to supply the farmers with essential actual information like weather forecasts, prices of crops or warning against pests. They are also used for farm comparison. AGROCOM, an example of a videotex service, is an initiative of the NCB (a farmers' association in the southern province Brabant) in which several organizations cooperate. It supplies the farmer with information and offers him the possibility to order supplies for his farm and to arrange his financial affairs. After a successful testing period, about 60% of the farmers want to continue to use the system. The use of videotex systems in The Netherlands is given in table 2.
- The use of personal computers on farms. The Dutch agricultural informatics policy is based on decentralisation, which implies the use of personal computers on farms. In all sectors efforts are made to arrive at standard communication interfaces between process computers and management computers. This way the farmer can automatically use the data of his process computer in the farm management system on his personal computer.
- Information models. These are a form of standardization, which will be described in the next paragraph.

Information models

An information model characterizes a farm or nursery. It describes the data, the activities and the interactions between them that are involved with decision making in an certain agricultural sector. The information model is a frame of reference for every-one involved in building agricultural management information systems. The technique that is used is Information Engineering of James Martin.

The construction of the information model is a joined effort of the branch organizations and agricultural researchers. First global information models were made for the various sectors. Most of these were published in 1986. Next the global model of a sector was divided into a certain number of clusters, that were each further specified as a detailed information model. At this stage more organizations participated, like the extension service, private companies and representatives of the farmers.

The aims of the information models are:

- Standardization of algorithms and definitions. This is an absolute condition for the integration of software and the communication between different hardware systems. It also makes it easier for members of the extension service to interpret the results of a certain farm and to compare them with those of other farms.

Table 1

Estimates of the use of micro computers on farms with a management system (source: COAL) compared to the total numer of ramers and growers in 1990

	1986	1987	1988	1989	1990	*farmers in 1990*
branch						
dairy	60	150	400	800	1100	490000
pigs	160	400	700	1400	2500	39000
poultry	20	75	150	250	270	2600
arable farming	60	185	260	600	900	17000
horticulture	100	400	1000	1250	150	22000
total	**400**	**1210**	**2510**	**4300**	**6270**	**129600**

- Co-ordination and integration of existing computer applications. A lack of co-ordination results in software that is often hardware dependent, in inadequate communication facilities between computers, in data that have to be entered separately in different software systems and in definitions that are not ambiguous, making it difficult to compare the results of one system with those of another system.
- Development of new computer applications. The information model can serve as a basis for further development of integrated software.

Post-INSP

From June 1990 to January 1991 a study has been made to examine the possibilities of a policy after the INSP will be finished (at the end of 1991), the so-called Post-INSP (Klink, 1991 and Geuze, 1991). This study indicates four subjects that should be emphasized in the near future:

- Advice during the interpretation of data.
- Data communication
- Expanding knowledge
- Co-operation

The extension service should more frequently support the users of management information systems and of systems for comparing the results of different farms. Improving data communication leads to obtaining better information on the farm level and receiving it faster. There is a growing interest in electronic data transfer between farmers and peripheral organizations like trade companies, extension service and accountancy offices. Recently the EDI-Agro platform was founded on the initiative of COAL, in co-operation with Dutch agribusiness. New knowledge is a prerequisite for improving process control systems, management information systems, decision support systems and other applications on the farms. To achieve optimal results all parties involved will have to co-operate very closely. This means that research, education, extension and software companies will have to work together to reach better solutions. The farmers and growers will have to direct and co-ordinate the development of agricultural software.

At present discussions take place about a permanent structure for the branch organizations and the strengthening of COAL activities. One of their tasks can be the co-ordination of updating the information models as new knowledge is developed and as farms and nurseries evolve.

Organizations involved in Agro Informatics

Wageningen Agricultural University

The department of Computer Science has the main responsibility for the teaching of courses in Computer Science that are taken by nearly all students of the various programmes. There are basic courses; courses in programming in Pascal, Fortran and Simula or Cosmos; advanced courses like system design, databases, knowledge systems, technical systems and finally possibilities for Thesis work. In co-operation with the department for Management Theory a course in Management Informatics is presented. In other departments courses are presented in which informatics and computer application play a great role, in relation to the field of study. Some courses are supported by computers or designed for study only with the aid of computers. There is no special programme in Informatics in Agriculture but the programme in Agricultural Systems and in Agricultural Engineering contain much of this informatics education.

Of all activities performed at the university about 800 work-year is spend on research. About 75% is organized in interdisciplinary research programs. Some of these programs are more or less related to informatics. These programs are:

- Decision Support Systems in Agriculture and Horticulture.
- Models of animal production systems.
- Optimization of production in glasshouses.
- Geographic Information Systems and teledetection.
- Knowledge transfer in Agriculture.
- Integrated Transport and Distribution Management.

A large number of projects of various departments are combined in these programs. Subjects of study are related to: decision support systems, management, economic or plant production models, simulation, system development, expert systems, teledetection, machine vision, operational research, computer integrated farming, information technology and knowledge transfer.

Agricultural Research Institutes

The Agricultural Research Department (DLO) is responsible for the eighteen agricultural research institutes. More than fifty percent of all agricultural research in The Netherlands is done by these institutes (DLO, 1990). One of the highlights in the research of DLO is the subject "Information Systems". The development of computerized Agro Information systems, farm management systems and equipment for automation of processes is emphasized. The agricultural research efforts fit into the INSP. The research of the institutes is concentrated in so-called research programmes. In table 3 some examples of

Table 2

The Use of videotex in the Netherlands (Geuze, 1990)

	1987	1988	1989
Dairy			
veeNET	-	120	250
Agrotel	-	-	225
Arable farming			
VITAK	170	220	360
Horticulture			
Exchange production result	150	300	360
Vegetables and fruits	320	380	360
Flowers	880	13340	2300
Total	**1520**	**2360**	**4870**

Table 3

Examples of the research programmes that relate to Agro Informatics at different research institutes in the Netherlands (DLO, 1991)

- **Agro-technological Research Institute (ATO)**
  Agro-logistics, artificial intelligence, video-image analysis and process optimization.
- **Centre for Agrobiological Research (CABO)**
  Simulation and systems analysis
- **Centre for Poultry Research and Information Services (COVP)**
  Use of information technology in poultry production and processing
- **Institute of Agricultural Engineering (IMAG)**
  Development of management and information systems (IMAG/LEI).
  Automation and robotization in dairy husbandry.
  Automation in pig and poultry husbandry.
  Automation and optimization of 'outside cultures'.
- **Centre for integrated Land, Soil and Water Research (SC)**
  Geographic Information Systems
- **Technical and Physical Engineering Research Service (TFDL)**
  Consultancy and research in information technology.

research programmes at various institutes are given that are relevant to Agro Informatics.

Each research programme contains several research projects. Just a few examples of the subjects of research are: the development of models to optimize processes and of Decision Support Systems; the simulation of crop growth; the development of automatic systems for feeding and milking and of sensors in order to increase the quality of the product and to decrease the costs of production; applying methods and technical means (hardware and software) in geographic information systems (GIS).

The main task of the research institutes is to produce knowledge and to apply and translate fundamental research of the university so that it can be incorporated in agricultural software and hardware. For this purpose prototypes of decision support systems or process control systems are often build. These prototypes can be used to examine the effects of these systems and to improve knowledge about them. The final phase of making a commercial product out of these prototypes is handled by private software companies.

Agricultural Research Stations

The strength of agricultural research is the continuing integration of new knowledge into farming systems. This integration is the main task of agricultural research stations. There are ten of such stations and they are branch- or product-oriented (e.g arable crops, vegetables and pigs). A broad spectrum of specialists, cultivation specialists, economists etc. are working in each station. They are supported by their colleagues at the research institutes. Farmers and growers organizations provide fifty percent of the budget.

The application of Agro Informatics at the agricultural research stations is always branch specific. Sometimes prototypes of the research institutes are further tested and developed. In other cases new prototypes are developed by the research stations, sometimes in co-operation with private companies. Examples of projects at the glasshouse crops research station are: decision making in crop protection, the development of management advisory systems and the automation of labour budgets.

Agricultural Extension Service

The regional extension services (DLV) used to be a part of the public service of the Ministry of Agriculture, Nature Management and Fisheries, but now they are in the process of becoming private advisors that will have to be payed by the farmers. DLV has a central Department of Informatics, that is responsible for the use of information technology within the organization. At the beginning of 1990 about 30% of the advisors had their own microcomputer. They are now looking for sophisticated means of assistance, which will enable them to support the farmers more efficiently. Farm management systems will be used as advisor support systems on a large scale in the near future. Information technology will also be used to support communication and the flow of information. An electronic mailbox can be used by the farmers to exchange messages with the extension service. DLV supports the standardization of software by using the information models as a basis for the development of new systems.

Some larger companies like animal feed suppliers have their own private extension service. These companies develop software that enables their advisors to communicate with the head office, e.g. to send in the orders of feed each day.

Vocational Schools in Agriculture

Both on own initiative as well as supported by the INSP the various educational institutions in Agriculture introduced informatics in their study programs.

In The Netherlands there are six schools for Higher Vocational Education. Also in this education informatics is presented in four categories: Basic knowledge, programming, introduction to system development and computer application. At two of these schools a specialised programme in Agro Informatics is available.
At the schools for Secondary and Elementary Vocational Education in Agriculture mainly the application of informatics in farm tools like control systems and management support systems is taught. At special schools for practical education these tools are also available to work with.
A special Centre (STOAS-CILO) was established to support the vocational schools with their education in Informatics by developing courseware and administration systems.

Agricultural software houses and hardware industry

A relatively large number (60) of small private companies is involved in developing agricultural software. Most of them are operating branch specific and

they are often adopting software to the wishes of single users.

Some larger companies exist that deal with several branches. Only recently a merging occurred between three medium large companies, resulting in a large company of 220 people. They occupy themselves with system development and the development, management and maintenance of (standard) software. Their service office supports the administrative activities of different agricultural organizations.

One large company is specialized in the development of chips that are implanted in animal stock. In this way management systems can be based on individual recognition of the animals.

Telematics is applied by large companies e.g. in the horticultural sector by the auctions. TeleVBA links the growers and the auction and gives information about prices, details about the plants or flowers sold and some other statistics.
EDI-flower is a project that looks at the possibilities of electronic data interchange between auctions and trade companies.

At the moment the commercial software companies still have to deal with some problems. The development of software based on the information models starts of laboriously. Some small companies stay in a phase of pioneering and it is doubtful if they have a perspective to maintain their position on the agricultural software market. The farmers and growers tend to have only short term views, which leaves not enough possibilities for long term development of farm management systems. The market for agricultural software is growing but not always fast enough yet. Therefore software companies often hesitate to develop new systems, before they have sold enough of the existing software module.

The agricultural software houses and hardware developers are co-operating in the "Agrarica Platform" a society that was founded in 1986 by a number of companies that recognized the importance of giving direction to the fast development of Agro Informatics. The society wants to constitute a recognizable partner in discussions with the government and farmers' organizations. Some of the activities of the Agrarica Platform are determining standards and specifications for products and services, initiating questions for research and constructing rules for the delivery of products.

Evaluation and prospects

Agro Informatics has been growing considerably in the past years in The Netherlands. After a period in which process control, data collection and data processing systems have been very important, now management information systems and Decision Support Systems (like planning and expert systems) will become more significant. Their growth sofar has stayed behind expectations formulated in the INSP (NRLO, 1991). One of the reasons for this is the fact that agriculture still is in the phase of "automated islands" or just at the beginning of the phase of linking different systems. The ideal phase of total integration will still need some time to be accomplished.

The support by INSP of the introduction of informatics in Agriculture has nevertheless been successful although much still has to be done.
Standardisation of applications has a high priority, especially in the international context. Informatics has also given a new push for research necessary for detailed information needed in management and knowledge support systems. Up until now stimulating the use of information technology has been emphasized, but in the near future this will change towards developing an information policy. This means that not the technology, but information as such will take a central position (Klink, 1991).

Many organizations are involved in the introduction of information technology on farms. Only through co-operation of the various parties involved, major results can be obtained. If the introduction of Agro Informatics is to be successful on the long run some important factors will have to be taken into account.

Agricultural software will have to be improved. Different hardware and software systems will have to be integrated e.g. to reduce data input. As new knowledge and technology evolves, research will have to find ways to apply it in practice. This can e.g be accomplished by building prototypes, which can be analyzed on farms. At the same time information models will constantly have to be updated not to become obsolete. When these prototypes are sufficiently tested, private companies can further develop them and integrate them in a commercial farm management system. Although each farmer has individual wishes, it will be necessary to develop standard agricultural software to keep development costs as low as possible.

In order to stimulate farmers and growers to use information technology on their farms, they will have to be better informed about the potential of these systems. This can be realized e.g by giving special courses on the use of farm management systems at the Agricultural Schools. Once the farmer has decided to implement a farm management system on his own micro computer, he needs full support of the extension service e.g. to interpret the outcome of the models. The user-friendliness of the agricultural software is also very important, e.g. the farmer has to spend as little time as possible to learn how to operate the system.

The extension service will play an important role in the further introduction of Agro Informatics. First of all as a user of advisory support systems, but also in the process of the interpretation of results on the farm level.

When activities like research, education, extension and software development are sufficiently co-ordinated in the years to come, Agro Informatics in The Netherlands will go through another period of growth.

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Agricultural Computing in the United States

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Agricultural Computing in the United States has received much attention since the late seventies and early eighties. Early efforts in computer applications in agriculture centered around mainframe machines accessed by farmers for services such as weather and market information. With a few notable exceptions, the number of users of computer systems in different areas of agriculture was extremely small. Shortly after the introduction of mass-produced microcomputer systems, efforts to extend these computer technologies into production agriculture where conducted through the Land-grant University System by the Cooperative Extension Service. At the same time, an industry addressing the software applications of computers in agriculture emerged. As MS-DOS and IBM compatible machines became the dominant fraction of the microcomputer market, a de facto pseudo-standardization occurred and the percentage of farms using computer systems grew steadily, particularly for record-keeping applications. In 1982 some estimates placed the percentage of computers in agricultural businesses under 5%, by 1988 some of these estimates placed the percentage over 20%.

The role of the government

Government policy has been to diffuse computing technology into agriculture through supporting the development of the required infrastructure and applications that could be used at the production system level. Development, implementation and distribution has been done mainly through the Cooperative Extension Service.

Information Delivery Systems

It was clear since the first applications of computing technologies to agriculture that the computer system can enhance the delivery of information to agricultural audiences. Early efforts relied on central mainframe computers that provided limited services, usually based on the VideoText concept. Because of the high cost to the user, impossibility of developing and maintaining the wide range of the software required, and the increasing availability of low-cost microcomputer systems and general application software, most of these systems disappeared or evolved into networks.

Current computer-based information delivery efforts center around distributed systems and networking, and some rely heavily on CD-ROM media for delivery and distribution. Information delivery is implemented using hypertext systems and includes access to databases, graphic and photographic images, expert systems and applications software for design and management of agricultural systems.

Education of agricultural audiences

A major continuing effort carried out by the Cooperative Extension Service is the education of potential and current users in the application of computers in